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1	279	53/399.ccls. and spring	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/31 15:10
2	198	53/589.ccls. and spring	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/31 15:10
-	179	100/26.ccls. and spring	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/31 12:34
-	51	100/31.ccls. and spring	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/31 12:39
-	2	3157109.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/31 12:38
-	9	3157109.URPN.	USPAT	2003/12/31 12:38
-	101	100/32.ccls. and spring	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/31 15:09

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United States Patent [19]

Kuei

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[54] **STRAP-FEEDING MECHANISM FOR AN AUTOMATIC STRAPPING MACHINE**

[75] Inventor: **Li Pi Kuei**, Taipei Hsien, Taiwan

[73] Assignee: **Gin Dah Enterprise Corp.**, Taipei, Taiwan

[21] Appl. No.: **865,908**

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[51] **Int. Cl.**[6] **B65B 13/06**

[52] **U.S. Cl.** **100/4**; 100/26; 100/32; 53/589

[58] **Field of Search** 100/4, 26, 29, 100/32; 53/589

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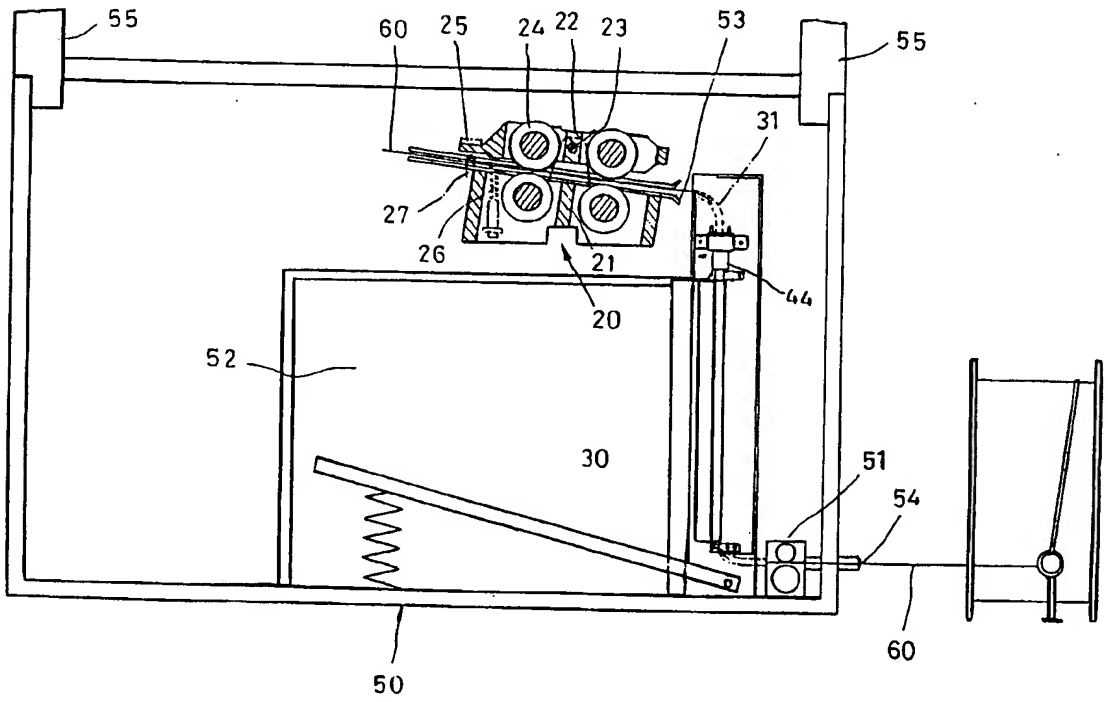
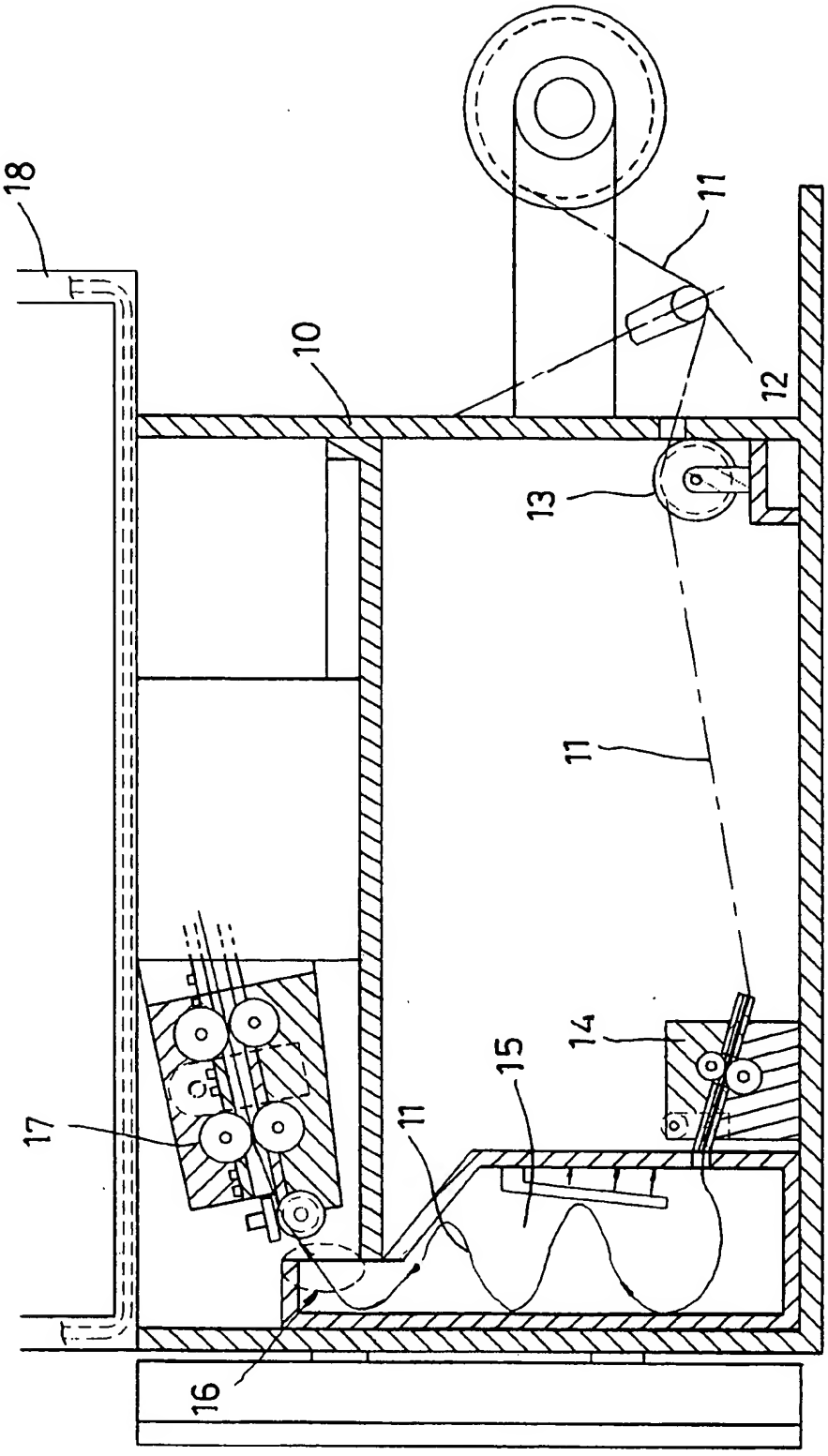
Primary Examiner—Stephen F. Gerrity
Attorney, Agent, or Firm—W. Wayne Liauh

[57] **ABSTRACT**

A strap-feeding mechanism for an automatic strapping machine including a quick strap-feeding mechanism for quickly feeding a strap into a strap rail on the automatic strapping machine and an automatic strap-refeeding mechanism for clamping a strap which slides off the strap rail during a pull-back operation, so that the strap is prevented from further sliding backward and is automatically refed into the strap rail again. The quick strap-feeding mechanism mainly includes a stationary panel and a cover panel. The stationary panel is provided with a strap guiding channel which has a lower end connected to a strap outlet of a strap-storing power unit, an upper end connected to a strap inlet of a strap-feeding unit, and a straight middle section having only one side wall. The cover panel is fixed to a front of the stationary panel and has a movable leaf which can be turned to extend into the stationary panel and forms another side wall of the straight middle section of the strap guiding channel. The strap refeeding mechanism includes a driving wheel and an opposite rotational wheel extending into the upper end of the strap guiding channel to together clamp the strap slidden off the strap rail and then refeed the strap into the strap rail.

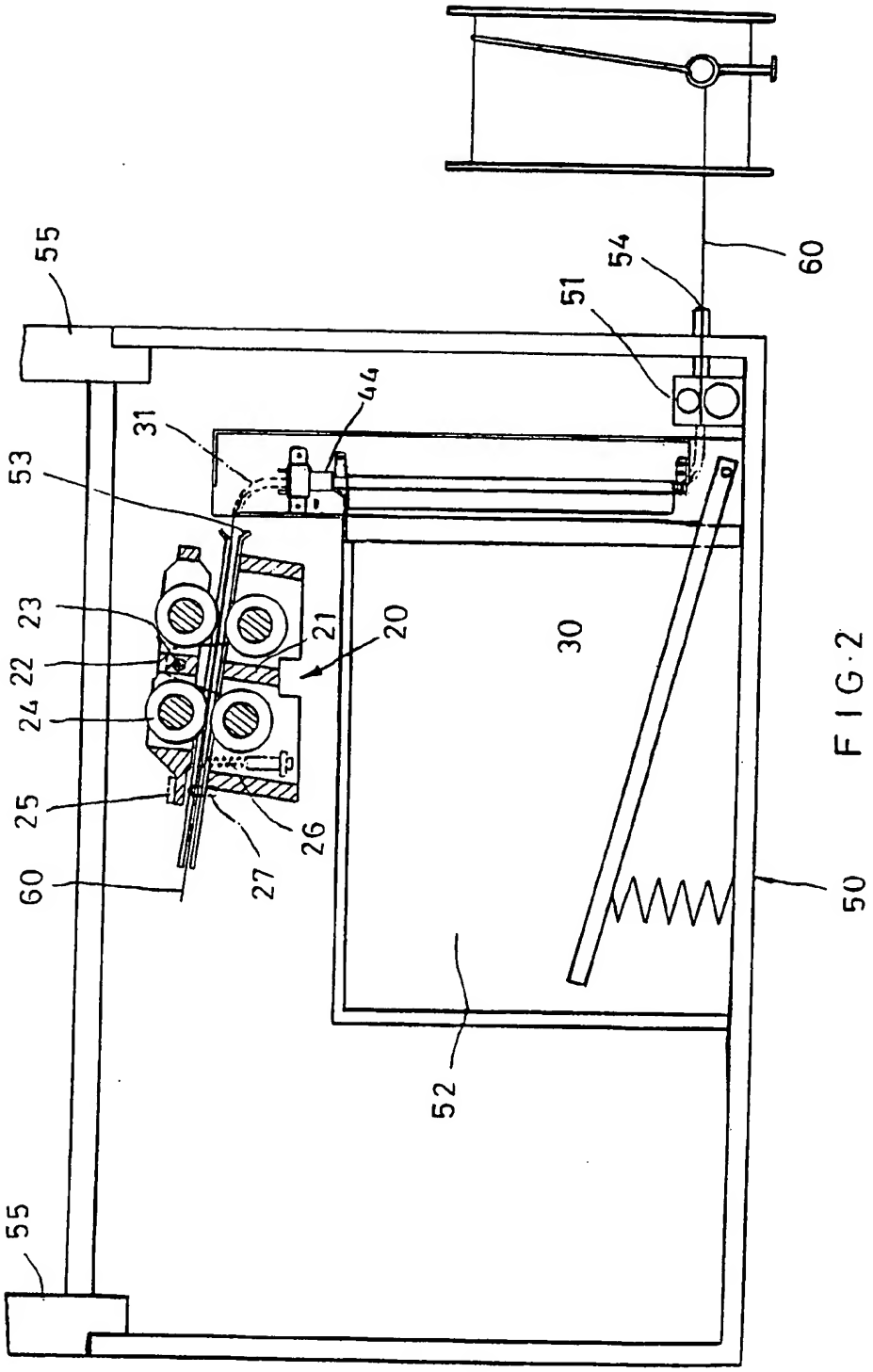
3 Claims, 8 Drawing Sheets



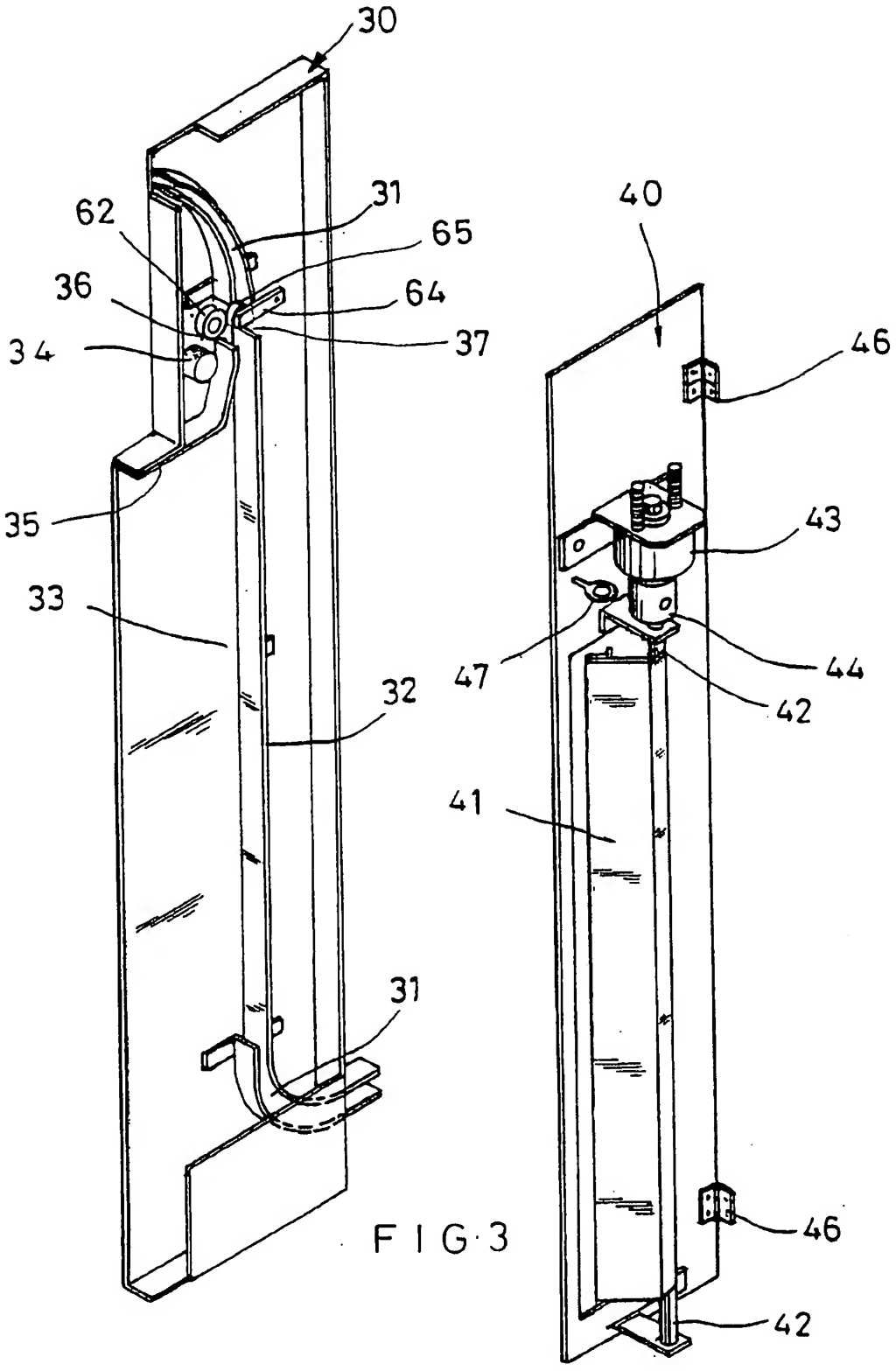


PRIOR ART

FIG. 1



FIG·2



FIG·3

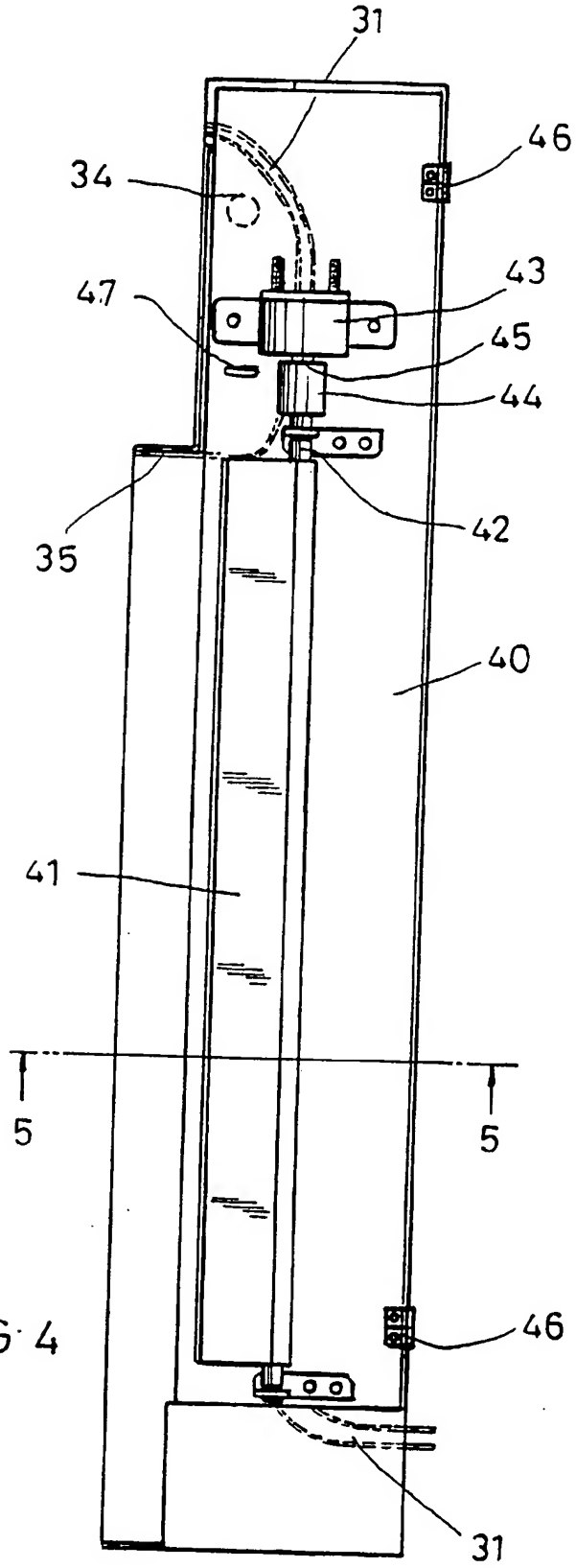
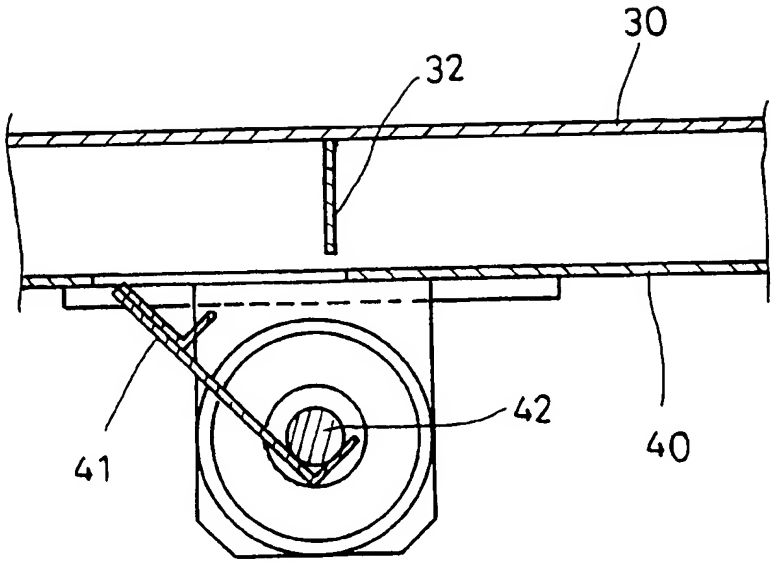
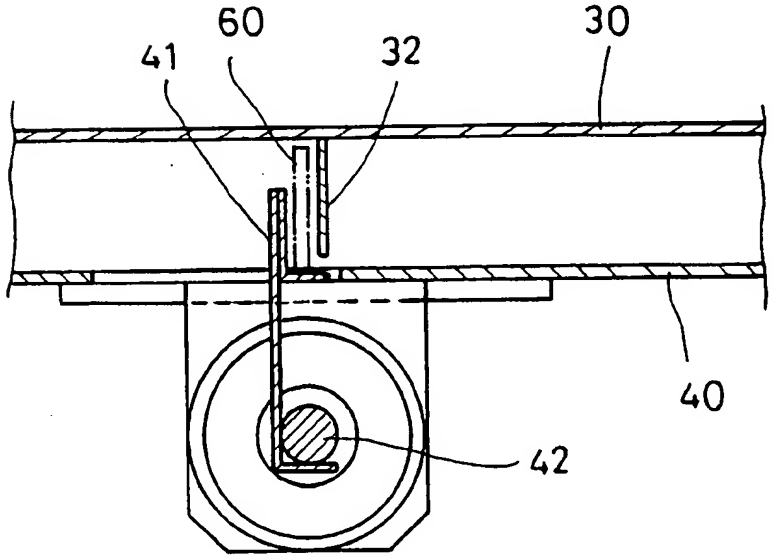


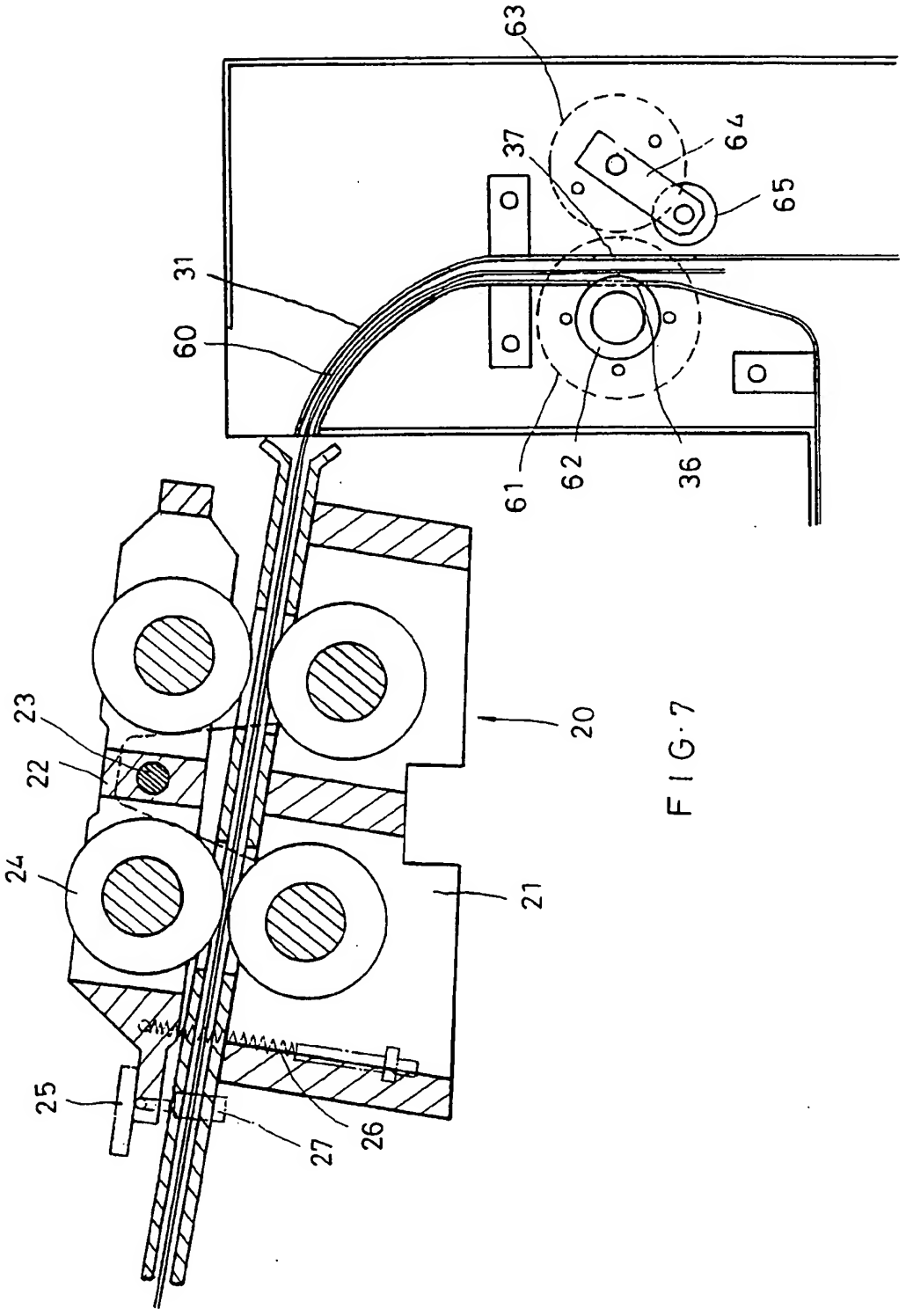
FIG 4



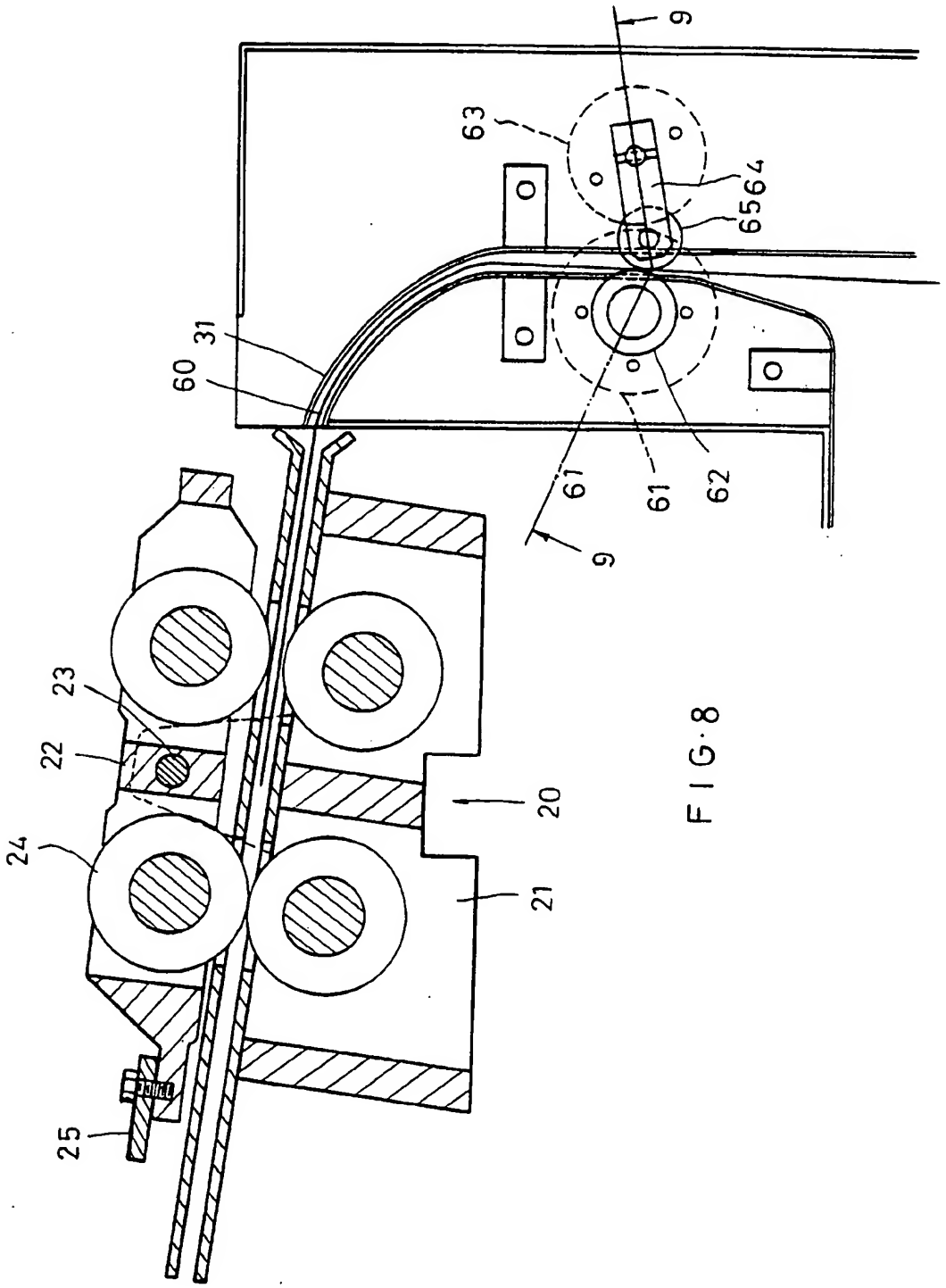
FIG·5



FIG·6



FIG·7



FIG·8

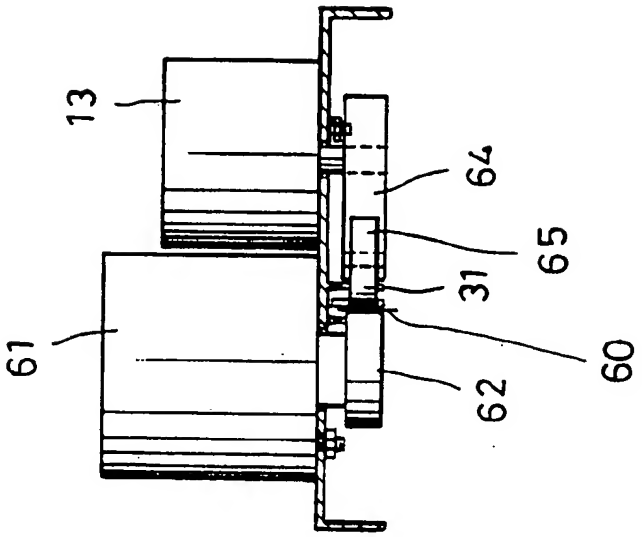


FIG. 9

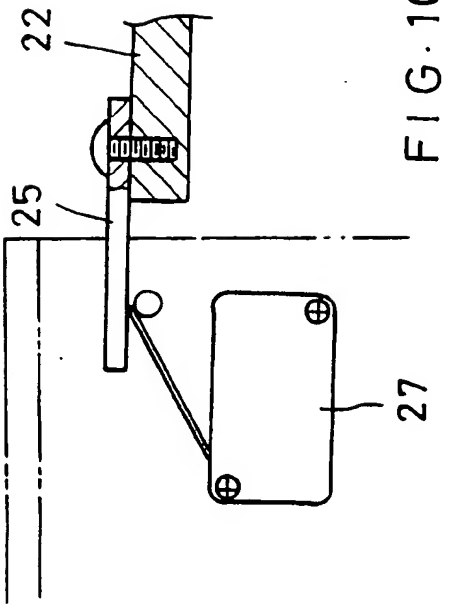


FIG. 10

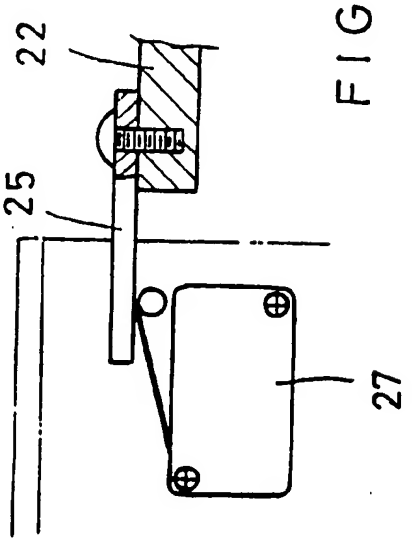


FIG. 11

STRAP-FEEDING MECHANISM FOR AN AUTOMATIC STRAPPING MACHINE

BACKGROUND OF THE INVENTION

In a strapping machine, there is a strap-feeding mechanism being driven to operate by a driving motor (which can rotate in forward and reverse directions alternately) to feed and pull backward a continuous strap for winding about and tightly strapping up something. To enable the strap to be fed and pulled backward smoothly, it is a common practice to provide a strap storage between a strap-feeding unit and a strap-storing power unit. The portion of a strap being pulled backward by the strap-feeding unit is temporarily stored in the strap storage. The strap-storing power unit shall timely rotate to guide the strap from a strap roll outside the strapping machine into the strapping machine. The strap being guided into the strapping machine is first stored in the strap storage in a zigzag form and is ready for the next feeding of strap.

FIG. 1 generally illustrates a strap-feeding mechanism in a conventional automatic strapping machine. To guide a beginning of the strap **11** into the strapping machine, a door covering the machine must be fully opened first, so as to completely expose an interior of a strap storage **15**. Then, the strap **11** is pulled and guided with hands from a strap roll outside a machine housing **10** to pass a brake **12** and extend into the machine housing **10**. With the help of a strap guiding roller **13**, the strap **11** is further guided to an inlet of a strap-storing power unit **14**. Thereafter, a push-button switch (not shown) of the strap-storing power unit **14** is pushed to cause rollers in the unit **14** to rotate at high speed and the strap **11** passing through the unit **14** is successfully guided into the strap storage **15**. The beginning of the strap **11** is moved toward an opening **16** at a top of the strap storage **15** and is further manually pulled and guided into an inlet of a strap-feeding unit **17**. A push-button switch (not shown) of the strap-feeding unit **17** is pushed to cause rollers in the strap-feeding unit **17** to rotate at high speed. The strap **11** passing through the strap-feeding rollers rotating at high speed is thereby directly guided into a strap rail **18** above the machine housing **10**.

Following drawbacks and disadvantages are found in the guiding and feeding of the strap **11** with the above conventional strap-feeding mechanism in the automatic strapping machine:

1. The door covering the machine housing must be fully opened before the strap can be guided into the strapping machine. Therefore, a considerably large space is required to locate the machine. Otherwise, it is necessary to move the machine frequently to a spacious place for opening the door.
2. The strap **11** is manually guided and threaded through different parts in the strapping machine before it is fed into the strap rail **18**. This is of course very troublesome and inconvenient. An operator must often bow or extend his body and hands into the machine housing to complete the guiding of the strap.
3. To successfully guide the strap **11** into the strap rail **18**, the operator must insert the beginning of strap into the strap-feeding unit **17** and press to hold the strap **11** in place with a hand, lest the strap **11** should slide backward into the strap storage **15**. However, since the opening **16** at the top of the strap storage **15** is small and a distance between the opening **16** and the inlet of the unit **17** is short, it is very possible that the operator's hand holding the strap **11** shall be dangerously brought to collide with the unit **17** when the switch of the strap-feeding unit **17** is pushed and the strap **11** is instantaneously moved forward at high speed.
4. The steps of feeding the strap in the conventional strap feeding mechanism are complicate and require a lot of time and labor, and the automatic strapping machine is therefore low efficient in its operation.

After a package is strapped on the automatic strapping machine, the strap **11** shall be automatically fed into the strap rail **18** for a next strapping. There are chances the strap **11** is not fed to a predetermined position for the next strapping during the procedure of automatic feeding of strap into the strap rail **18**. In this case, the strap **11** will be completely pulled back into the strap storage **15** when the rollers in the strap-feeding unit **17** pull the strap **11** backward to tightly wind about the package to be strapped. At this point, the operator must expose the strap storage **15** to insert the beginning of the strap **11** into the strap-feeding unit **17** again, so that the strap **11** can be fed into the strap rail **18**. This will of course bring a lot of troubles to the operator and waste a lot of time. Since the reason that results in such conditions might be a mechanical problem in the mechanism or a problem in the strap itself, it requires many times of trial and error to determine the real cause. The same movements of guiding and inserting the strap **11** shall be repeated after each trial. The operator will inevitably become impatient with this time-consuming work.

It is therefore tried by the inventor to develop a strap-feeding mechanism for an automatic strapping machine to eliminate the drawbacks existing in the conventional strap-feeding mechanism.

SUMMARY OF THE INVENTION

The strap feeding mechanism for an automatic strapping machine according to the present invention includes a quick strap-feeding mechanism and an automatic strap-refeeding mechanism. The quick strap-feeding mechanism can quickly and automatically feed the beginning of a strap into a strap rail of the automatic strapping machine. And, the automatic strap-refeeding mechanism can automatically refeed the strap when it slides off the strap rail.

The quick strap-feeding mechanism of the present invention mainly includes a stationary panel and a cover panel. The stationary panel is provided with a strap guiding channel. A lower end of the strap guiding channel is connected to an outlet of a strap-storing power unit in the strapping machine. An upper end of the strap guiding channel is connected to a strap inlet at a first end of a strap-feeding unit in the strapping machine. A vertical straight middle section of the strap guiding channel has only one side wall. The cover panel is assembled to the stationary panel to form a front cover of the stationary panel. A vertically extended movable leaf is fixed to the cover panel such that a front edge of the movable leaf does not project into the stationary panel when the vertical movable leaf is in its normal position. When the beginning of the strap is to be fed into the strap rail, a first electromagnetic thread rod is actuated to cause the front edge of the movable leaf to turn toward the stationary panel by 45 degrees, so that a front portion of the movable leaf forms another side wall of the vertical section of the strap guiding channel in the stationary panel.

A driving wheel driven by a small motor is provided at one side of a section of the strap guiding channel between the strap-feeding unit and a strap storage. The driving wheel is so located that a part of it extends into the strap guiding channel. An arm member driven by a second electromagnetic thread rod is provided at another side of the strap

guiding channel opposite to the driving wheel. A rotatable wheel is pivotally connected to a free end of the arm member. When the second electromagnetic thread rod is actuated, it drives the arm member to turn into the strap guiding channel so that the rotatable wheel pivotally connected to the free end of the arm member contacts with and presses against the driving wheel in the strap guiding channel.

The strap-refeeding mechanism includes a strap-feeding unit which has an upper movable seat supporting rollers for feeding the strap forward. A press plate is provided on the movable seat near a second end of the strap-feeding unit opposite to the strap inlet at the first end of the strap-feeding unit. In the event the strap-feeding rollers pull the strap backward to tightly strap a package and the strap slides off the strap rail and even the strap-feeding unit, the strap-feeding roller that is mounted on the movable seat at the second end shall descend because there is no strap passing below it. The press plate provided on the movable seat shall descend at the same time to touch a microswitch below it, and the microswitch in turn immediately actuates the second electromagnetic thread rod, so that the arm member and the rotatable wheel connected thereto extend into the strap guiding channel to together with the driving wheel clamp the slidden strap. Then, the small motor is actuated to rotate the driving wheel and send the strap back into the strap-feeding unit, allowing the strap to be fed into the strap rail again by the strap-feeding rollers.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates the structure of a strap-feeding mechanism of a conventional automatic strapping machine;

FIG. **2** illustrates the structure of a strap-feeding mechanism of an automatic strapping machine according to the present invention;

FIG. **3** is a disassembled perspective of the stationary panel and the cover panel together forming the quick strap-feeding mechanism of the present invention;

FIG. **4** is a front elevational view of the assembled stationary panel and cover panel;

FIG. **5** is a sectional view of the assembled stationary panel and cover panel taken on line **5**—**5** of FIG. **4**;

FIG. **6** is a sectional view of the assembled stationary panel and cover panel taken on line **5**—**5** of FIG. **4** but with the movable leaf of the cover panel forming a side wall of the strap guiding channel in the stationary panel;

FIG. **7** is a fragmentary front view particularly showing a top portion of the stationary panel;

FIG. **8** illustrates the manner in which a slidden strap is refed by the present invention;

FIG. **9** is a sectional view taken on line **9**—**9** of FIG. **8**;

FIG. **10** is a fragmentary side view showing the microswitch in an non-actuated state; and

FIG. **11** is similar to FIG. **10** but with the microswitch in an actuated state.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention relates to a strap-feeding mechanism for an automatic strapping machine. The strap-feeding mechanism further includes a quick strap-feeding mechanism and a strap-refeeding mechanism.

The quick strap-feeding mechanism of the present invention includes a stationary panel **30** and a cover panel **40** and is installed within the automatic strapping machine **50**, as shown in FIG. **2**.

Please refer to FIGS. **2**, **3** and **4** at the same time. The stationary panel **30** is provided with a strap guiding channel **31** for guiding a strap **60** to move forward. The guiding channel **31** has a lower end which is connected to a strap outlet of a strap-storing power unit **51** in the automatic strapping machine **50** and an upper end which is connected to a strap inlet **53** of a strap-feeding unit **20** in the strapping machine **50**. A vertical straight middle section of the strap guiding channel **31** has only a right side wall **32** (when viewing from a front of the drawings) forward projecting from a front surface of the stationary panel **30**. A left side of the strap guiding channel **31** forms a vertical opening **33**.

The cover panel **40** is assembled to a front side of the stationary panel **30**. A vertically extended movable leaf **41** is fixedly mounted on a vertical shaft **42** which can be driven by a first electromagnetic thread rod **43** to turn 45 degrees, bringing the leaf **41** from a normal position to a projected position. Please refer to FIG. **5**, when the leaf **41** is in its normal position, a front edge thereof opposite to the shaft **42** does not project from the cover panel **40** into the stationary panel **30**. Please refer to FIG. **6**, when the first electromagnetic thread rod **43** is actuated, the leaf **41** is turned along with the shaft **42** by 45 degrees to extend into the stationary panel **30**, forming a left side wall of the vertical straight middle section of the guiding channel **31**. At this point, the strap **60** can be guided in the guiding channel **31** having complete right and left side walls to the strap-feeding unit **20**.

Please refer to FIGS. **3** and **7**. A small motor **61** is provided to a top left side of the guiding channel **31** to rotate a driving wheel **62** which has a part extends into the guiding channel **31** via a cut **36** formed on a top left side wall of the guiding channel **31**. A second electromagnetic thread rod **63** is provided to a top right side of the guiding channel **31** to turn an arm member **64**. A rotatable wheel **65** is pivotally connected to a free end of the arm member **64**. When the second electromagnetic thread rod **63** is actuated to turn the arm member **64**, the rotatable wheel **65** moves along with the arm member **64** and extends a part of it into the guiding channel **31** via a cut **37** formed on the right side wall **32** to contact with and press against the driving wheel **62**.

Please refer to FIG. **7**. The strap-feeding unit **20** has a lower fixed seat **21** and a top movable seat **22** above the fixed seat **21**. The movable seat **22** can slightly swing up and down about a pivotal center **23** thereof. A damping spring **26** is connected to a left end of the movable seat **22** to normally pull the left end of the movable seat **22** downward. Since this is a prior art, it is not described in details herein. What is to be noted is a press plate **25** is provided at a leftmost end of the movable seat **22**. When rollers of the strap-feeding unit **20** pull the strap **60** backward to tighten the strap **60** around a package and the strap **60** unexpectedly slides off a strap rail **55** and the strap-feeding unit **20** of the automatic strapping machine **50**, a strap-feeding roller **24** supported at the left end of the movable seat **22** shall descend a little, as shown in FIG. **8**, because there is no strap **60** passing below the roller **24**. This causes the press plate **25** at the leftmost end of the movable seat **22** to descend and press down a microswitch **27** below the press plate **25**, as shown in FIGS. **10** and **11**. At this point, the second electromagnetic thread rod **63** is actuated to drive the arm member **64** to turn a predetermined angle, bringing the rotatable wheel **65** at the free end of the arm member **64** to together with the driving wheel **62** clamp the retracted strap **60** and prevent the strap **60** from sliding backward any further. When the automatic

strapping machine **50** completes a second time strapping movements (which is a preset operation in the automatic strapping machine), the small motor **61** is actuated to drive the driving wheel **62** to rotate, so that the strap **60** clamped between the driving wheel **62** and the rotatable wheel **65** is moved forward and fed into the strap rail **55** again.

To send the beginning of the strap into the automatic strapping machine **50**, first actuates the first electromagnetic thread rod **43** so that the movable leaf **41** is turned by 45 degrees to become perpendicular to the stationary panel **30**, as shown in FIG. **6**, and forms the left side wall for the vertical straight middle section of the strap guiding channel **31** on the stationary panel **30**. Then, draw the strap **60** to extend it into the automatic strapping machine **50** via an insertion opening **54** formed on an outer wall of the machine **50**, so that the strap **60** enters the strap-storing power unit **51**. At this point, a strap-storing motor (which is a known element and is not shown in the drawing) in the strap-storing power unit **51**, the small motor **61**, and the second electromagnetic thread rod **63** are actuated at the same time to send the strap **60** to the strap-feeding unit **20**. Due to the strap **60** which passes between rollers of the strap-feeding unit **20**, the left end of the movable seat **22** is caused to ascend. This means the micro-switch below the leftmost end of the movable seat **22** is not in a contacted and pressed state and the small motor **61** and the second electromagnetic thread rod **63** are caused to stop operating. Meanwhile, the first electromagnetic thread rod **43** also stops operating, causing the movable leaf **41** to return to its normal position as shown in FIG. **5**, and the strap **60** can be continuously sent into the strap storage **52**. When the strap storage **52** is fully occupied with the strap **60**, the strap-storing motor in the strap-storing power unit **51** stops. At this point, a strap-feeding motor (not shown) is actuated to drive the strap-feeding unit **20** to feed the strap **60** direct into the strap rail **55**. And, the automatic strapping machine **50** is now ready for work. It can be found from the above description that the strap feeding in an automatic strapping machine with the strap-feeding mechanism of the present invention needs not to open any door covering the machine **50**. That is, the strap **60** can be quickly fed in an automated manner. And, the strap **60** which is pulled backward during an automatic strapping can smoothly enter the strap storage **52** via the opening **33** formed on the left side of the strap guiding channel **31**.

As shown in FIGS. **3** and **4**, the vertical shaft **42** fixedly supporting the movable leaf **41** is connected to a spindle **45** of the first electromagnetic thread rod **43** via a coupling **44**, so that the shaft **42** moves with the spindle **45**. When the first electromagnetic thread rod **43** is energized, the spindle **45** shall rotate by a predetermined angle. In the present invention, this angle is set to 45 degrees. When the first electromagnetic thread rod **43** is deenergized, the spindle **45** is returned to its original position by a return spring (not shown).

The cover panel **40** may be fixedly locked to the stationary panel **30**. However, to facilitate a troubleshooting during an operation of the automatic strapping, the cover panel **40** is preferably connected at a right side to the stationary panel **30** by means of hinges **46**, so that the cover panel **40** can be pivotally swung open relative to the stationary panel **30**. A magnet **34** is provided at a top left corner of the stationary panel **30** so that the cover panel **40** can be magnetically attracted to the stationary panel **30** and closes the front of the stationary panel **30**. A pull ring **47** can be provided to the cover panel **40** so that the cover panel **40** can be conveniently pulled open from the stationary panel **30**. A length of stopping wall **35** extends leftward from a top beginning of the opening **33** at the left side of the vertical straight middle section of the guiding channel **31**, so that the strap **60** can be smoothly guided into the strap storage **52** along the stopping wall **35**.

The operation for strap-feeding in the automatic strapping machine with the present invention can be proceeded simply by pressing a pushbutton switch to actuate the first electromagnetic thread rod **43**, so that the movable leaf **41** on the cover panel **40** is turned 45 degrees to form a left side wall of the strap guiding channel **31** on the stationary panel **30**. And, causing rollers in the strap-storing power unit **51** and the strap-feeding unit **20** to rotate at the same speed shall quickly feed the strap **60** into the strap rail **55** above the automatic strapping machine **50** so that the machine **50** is ready for use. With the above arrangements, the present invention provides simple, easy, and quick strap feeding for an automatic strapping machine. And, when the strap **60** unexpectedly slides off the strap rail **55** and the strap-feeding unit **20** while the strap **60** is pulled backward during a strapping operation, the strap **60** can be automatically refed into the strap rail **55** for a next strapping. This largely improves the strap feeding in an automatic strapping machine.

What is claimed is:

1. A strap-feeding mechanism for an automatic strapping machine, comprising a quick strap-feeding mechanism for quickly feeding a beginning of a strap into a strap rail on said automatic strapping machine and an automatic strap-refeeding mechanism for clamping a strap which slides off said strap rail during a pull-back operation, so that said strap is prevented from sliding backward any further and is automatically refed into said strap rail again.

2. A strap-feeding mechanism for an automatic strapping machine as claimed in claim **1**, wherein said quick strap-feeding mechanism comprises a stationary panel and a cover panel; said stationary panel being provided with a strap guiding channel, a lower end of said strap guiding channel being connected to an strap inlet of said automatic strapping machine and an upper end of said strap guiding channel being connected to an strap inlet of a strap-feeding unit of said machine, said strap guiding channel having a vertical straight middle section which has only one side wall and forms a vertical opening at another side facing a strap storage in said strapping machine; said cover panel being assembled to a front of said stationary panel and being provided with a vertically extended leaf, said leaf being driven by a first electromagnetic thread rod to turn 45 degrees from a normal position into a working position, a front edge of said leaf in said normal position being flush with said cover panel, said front edge of said leaf in said working position projecting into said stationary panel to close said vertical opening and forming another side wall of said strap guiding channel.

3. A strap-feeding mechanism for an automatic strapping machine as claimed in claim **1**, wherein said automatic strap-refeeding mechanism comprises a driving wheel provided at a left side of the top end of said strap guiding channel, a rotational wheel provided at a right side of the top end of said strap guiding channel opposite to said driving wheel, a press plate provided on a movable seat of said strap-feeding unit at an end opposite to said strap inlet of said strap-feeding unit, and a microswitch provided below said press plate; said driving wheel being driven by a small motor to rotate and having a part extending into said strap guiding channel via a cut on said guiding channel, said rotational wheel being pivotally connected to a free end of

an arm member which can be driven by a second electromagnetic thread rod to bring said rotational wheel to turn at the same time, said rotational wheel also having a part extending into said strap guiding channel via another cut on said strap guiding channel to contact with and press against said driving wheel, said press plate being in an ascendent position without touching said microswitch when said strap passes below said movable seat of said strap-feeding unit, and said press plate being in a descendent position when said strap slides off said strap-feeding unit and touching said microswitch to immediately actuates said second electromagnetic thread rod to rotate said arm member and said rotational wheel, whereby said rotational wheel together with said driving wheel clamp said strap in said strap guiding channel to prevent said strap from sliding backward any further, and said strap clamped by said driving wheel and said rotational wheel is refed into said strap rail by starting said small motor to rotate said driving wheel and by actuating said strap-feeding unit again.

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